CLAIMS

1. A controller for a switch reluctance motor (SRM), comprising:

a turn-on controller that includes a first component for controlling a turn-on angle during low speed operations and a second component for controlling the turn-on angle during high speed operations such that the two components automatically exchange control responsibility based on operating conditions; and

a turn-off controller having an algorithm for controlling a turn-off angle, wherein the algorithm calculates the turn-off angle as a function of rotor speed, reference peak phase current, and a set of curve fit parameters.

2. The controller of claim 1, wherein the set of curve fit parameters are predetermined from a set for the SRM in which a range of optimal turn-off angles are calculated as a function of rotor speed and peak phase current, wherein the data set is selected from the group consisting of: simulated data and experimental data.

3. The controller of claim 2, wherein the curve fit parameters are predetermined based on a least squares fit calculation of the data set over the range of optimal turn-off angles.

4. The controller of claim 3, wherein the algorithm consists of four curve fit parameters.

5. The controller of claim 3, wherein the algorithm is given by formula:

$$\theta off = k1\,\omega Iref + k2\,\omega + k3 * \mathrm{sqrt}(Iref) + k4\,,$$

where ω is rotor speed, $Iref$ is the reference current and $k1$, $k2$, $k3$ and $k4$ are the set of curve fit parameters.

6. The controller of claim 5, wherein the first component of the turn-on controller causes a rotor angle position associated with a first peak of the phase current to equal the rotor angle position where an inductance begins to increase.

7. The controller of claim 5, wherein the second component of the turn-on controller causes the turn-on angle to be advanced until peak current equals the reference peak phase current.

8. The controller of claim 1, wherein the turn-on controller includes a limiter for limiting the turn-on angle based on the turn-off angle.

9. A system for controlling a turn-off angle for a switch reluctance motor (SRM), comprising an algorithm that calculates the turn-off angle as a function of rotor speed, reference peak phase current, and a set of curve fit parameters.

10. The system of claim 9, wherein the set of curve fit parameters are predetermined from a data set for the SRM in which a range of optimal turn-off angles are calculated as a function of rotor speed and reference peak phase current, wherein the data set is selected from the group consisting of: simulated data and experimental data.

11. The system of claim 10, wherein the curve fit parameters are predetermined based on a least squares fit calculation of the data set over the range of optimal turn-off angles.

12. The system of claim 11, wherein algorithm consists of four curve fit parameters.

13. The system of claim 12, wherein the algorithm is given by formula:

$$\theta\text{off} = k1\,\omega Iref + k2\,\omega + k3*\text{sqrt}(Iref) + k4\,,$$

where ω is rotor speed, $Iref$ is the reference current and $k1$, $k2$, $k3$ and $k4$ are the set of curve fit parameters.

14. The system of claim 9, wherein the calculated turn-off angle is provided to a turn-on controller in order to provide a limit to a turn-on angle.

15. A program product stored on a recordable medium for controlling a switch reluctance motor (SRM), the program product comprising:

means for controlling a turn-on angle during low speed operations;

means for controlling the turn-on angle during high speed operations;

means for automatically transitioning between low speed and high speed operations based on operating conditions; and

means for controlling a turn-off angle, wherein said means includes an algorithm that calculates the turn-off angle as a function of rotor speed, reference peak phase current, and a set of curve fit parameters.

16. The program product of claim 15, wherein the set of curve fit parameters are predetermined from a data set for the SRM in which a range of optimal turn-off angles are calculated as a function of rotor speed and reference peak phase current, wherein the data set comprises either simulated or experimental data.

17. The program product of claim 16, wherein the curve fit parameters are predetermined based on a least squares fit calculation of the data set over the range of optimal turn-off angles.

18. The program product of claim 17, wherein the algorithm is given by formula:

$\theta\mathrm{off} = k1\,\omega Iref + k2\,\omega + k3 * \mathrm{sqrt}(Iref) + k4$, where ω is rotor speed, $Iref$ is the reference peak phase current and $k1$, $k2$, $k3$ and $k4$ are the set of curve fit parameters.

19. The program product of claim 15, wherein means for controlling a turn-on angle during low speed operations causes a rotor angle position associated with a first peak of the phase current to equal the rotor angle position where an inductance begins to increase.

20. The program product of claim 15, wherein the means for controlling the turn-on angle during high speed operations causes the turn-on angle to be advanced until peak current equals the reference peak phase current.

21. A switch reluctance motor (SRM) controller, comprising:

a first system for controlling a turn-on angle when the SRM operates below a base speed, wherein said first system causes a rotor angle position associated with a first peak of the phase current to equal the rotor angle position where an inductance begins to increase;

a second system for controlling the turn-on angle when the SRM operates above a base speed, wherein said second system causes the turn-on angle to be advanced until peak current equals a reference current;

a third system for automatically transitioning between operation at low speed and high speed; and

a fourth system for controlling a turn-off angle, wherein said third system includes the algorithm that calculates the turn-off angle as a function of rotor speed, reference peak phase current, and a set of pre-calculated curve fit parameters.

22. The SRM of claim 21, wherein the algorithm is given by formula:

$$\theta\mathrm{off} = k1\,\omega Iref + k2\,\omega + k3 Iref + k4\,,$$

where ω is rotor speed, $Iref$ is the reference peak phase current and $k1$, $k2$, $k3$ and $k4$ are the set of pre-calculated curve fit parameters.

23. A method for controlling a turn-off angle for a switch reluctance motor (SRM), comprising the steps of:

obtaining a reference current value from a speed controller of the SRM;

obtaining a rotor speed of the SRM; and

calculating the turn-off angle as a function of rotor speed, reference peak phase current, and a set of pre-calculated curve fit parameters.

24. The method of claim 23, wherein the set of curve fit parameters are pre-calculated from a simulated or experimental data set for the SRM in which a range of optimal turn-off angles are calculated as a function of rotor speed and peak phase current.

25. The method of claim 24, wherein the curve fit parameters are calculated based on a least squares fit calculation of the simulated data set over the range of optimal turn-off angles.

26. The method of claim 25, wherein the turn-off angle $\theta\mathrm{off}$ is given by formula:

$$\theta\mathrm{off} = k1\,\omega Iref + k2\,\omega + k3 * \mathrm{sqrt}(Iref) + k4,$$

where ω is rotor speed, $Iref$ is the reference peak phase current and $k1$, $k2$, $k3$ and $k4$ are the set of curve fit parameters.